

beyond the cell of double the size; the spots of the forked discal series of nearly equal size throughout and continued to the interno-median interspace near anal angle; a series of six minute white dots near the outer margin: secondaries with no spot between the first and second median branches, and the spot between the radial and the third median branch truncated at the end; abdominal area with the ground-colour pale brown. Expanse of wings 3 inches 2 lines.

More falcate than *D. purpurata*; in some respects nearer to *D. sobrina* and *D. meganira*.

Neptis cyanifera, n. sp.

Wings above black, bluish towards the base: primaries with a semicircular blue patch about the middle of the inner margin, and a round white spot above it, surrounded by blue scales, upon the first median interspace; a white subcostal dot just beyond the cell; two subapical white discal spots placed obliquely, and a submarginal series of six white or whitish small spots: secondaries crossed before the middle by an irregular quinquefid white stripe enclosed in a rather broad blue belt; three or four bluish dots parallel to the outer margin. Wings below chocolate-brown: primaries below with all the spots white, all excepting those of the submarginal series (which contains eight small spots) pearly; an additional spot near the end of the cell: secondaries with the base broadly sordid white, crossed by a blackish bar; a pearly white belt before the middle of the wing; a submarginal series of pinky white spots and a marginal series of longitudinal pinky white dashes. Expanse of wings 2 inches 2 lines.

Allied to *N. Brebissonii*, *N. mortifacies*, and *N. lactaria*.

LV.—On the Nauplius Stage of Prawns.

By Dr. FRITZ MÜLLER *.

AFTER the appearance of the essay on the metamorphosis of the Prawns †, Spence Bate expressed to me his doubts on the connexion of the young forms described by me. Properly one should never refer larvæ to definite grown-up animals unless obtained from the ova and the latter from the parent. My *Nauplii* had been caught while swimming freely in the sea, and possibly might not be the larvæ of *Penæus* at all.

* Translated from 'Zeitschrift f. wiss. Zool.' Bd. xxx. p. 163.

† Archiv für Naturgeschichte, xxix. 1, 1863, p. 8.

Alexander Agassiz has since expressed himself similarly; and I also find the same doubts repeated by Dr. Paul Meyer* in a criticism of Claus's latest work ('Investigations for the Discovery of the Genealogical Foundation of the Crustaceous System').

The development of *Nauplius*-like larvæ into Macrurous Crustacea is of such importance to the genealogy of the Crustacea that it does not seem superfluous to point out once more the reasons which induce me even now to look upon the course of development described by me as a completely assured fact. I repeat, for this reason, literally, what I wrote in October 1864 as a reply to Spence Bate's doubts.

The requirement that one should only ascribe early forms to definite parents when one has obtained them from the ova taken from the parent, seems to me to be unreasonable.

If one admitted that, it would naturally be demanded not only for the earliest forms, but, with equal justice, for all young (intermediate) forms. It would be necessary to demand for every stage either that it be reared from the ovum or preserved alive until it arrives at sexual maturity; and this condition would compel us to give up the study of the development of most marine animals. I contend that it is quite enough that we should be able to unite the terminal members of the series by a continuous chain of intervening forms so closely united that there cannot be any reasonable doubt about the connexion of any two successive forms. But the proof of the connexion of my *Nauplius* with the *Peneus*, or a genus nearly related to it, I believe to have been established in a sufficient manner.

In a journal which has only twelve plates in a year I could not, as Spence Bate has done for his memoir on the development of *Carcinus menas*, obtain seven plates for one essay. I had therefore to limit myself to illustrating only a few of the most interesting forms out of fifty pages of drawings of the development of the prawns produced from the *Nauplius* stage.

At the same time it appeared to me unnecessary to remark that the metamorphosis of one form into the other had not been imagined, but was the result of close observation of numerous larvæ.

Only in one place there were not at my command intervening forms in abundance.

Between the *Nauplius* (pl. ii. fig. 2) and the *Zoëa* represented in fig. 4 I had only one opportunity of observing (in the same species) two intervening forms, which I mentioned—

* Jenaer Literaturzeitung. 1877, No. 16, p. 247.

an older *Nauplius* whose third pair of legs I drew in fig. 3 (in four specimens), and one younger *Zoëa*.

But as it is just against this point, and, as far as I know, against this point exclusively, *i. e.* against the relation of the *Nauplius* with the *Zoëa*, that the doubts are directed of those who cannot believe in the metamorphosis of a *Nauplius* into a long-tailed crustacean, I will once more place together the peculiarities in which the oldest *Nauplius* agrees with the youngest *Zoëa*.

In the first place, they have the same highly peculiar mode of movement, by which they are distinguished at once from all other marine Crustacea.

In the second place, they have the same colour. The two anterior pairs of limbs and the fork-like caudal extremity especially show a peculiar brown colour deepening towards the extremity, which I do not find in any other Crustacea of our sea.

In the third place, the proportional length and the whole appearance of the first two pairs of limbs are the same; only they are more distinctly articulated in the *Zoëa*, and the second pair is more profusely ciliated: instead of three hairs on the end of the inner branch, there are four. Likewise the posterior extremity of the *Zoëa* differs only in having the two branches further asunder, and in having first seven and still later eight hairs on each branch, instead of six as in the oldest *Nauplius*.

In the fourth place, from the structure of the third pair of limbs (fig. 3) of the oldest *Nauplius* it is evident that after the next change of skin it must have mandibles with an acute, prominent tooth, and a broad, transversely furrowed masticatory surface, and that the mandible must bear a dark brown, non-setigerous appendage. The youngest has such a mandible, and bears such an appendage; and it may be remarked that the *Nauplius* was observed on the 24th of January, and the *Zoëa* on the 3rd of January, when I had no idea of the significance of this appendage to the mandible. I am acquainted with no similar appendage in any other Crustacean, young or old.

In the fifth place, we see in (*i. e.* from the structure of) the oldest *Nauplius*, that the next stage of development must possess four more pairs of limbs; the youngest *Zoëa* does possess four more pairs of limbs, corresponding in form to the rudiments present in the *Nauplius*.

In the sixth place, the formation of the heart, intestines, and liver is exactly the same in the oldest *Nauplius* and youngest *Zoëa*.

In the seventh place, in the oldest *Nauplius*, on each side

near the frontal margin was seen an opaque mass of minutely granulose texture, and extending beyond it a small round tubercle. The same is observable in the youngest *Zoëa*. From this mass are developed at a later period the paired eyes; and on them the tubercle is retained as far as the *Mysis* stage (fig. 9, o). I know of no other Crustacean with any such tubercle.

And with all these points of resemblance, what then are the differences? That the *Zoëa* is a little larger—that the carapace, already indicated in the *Nauplius*, is well developed—that the feet present as rudiments have come into action—that a few new setæ have been added,—steps in advance, every one of which might have been predicted.

I should have supposed that these reasons would pretty well suffice to convince the most obstinate doubters. However, if my *Nauplius* be not derived from a *Pencæus*, and is not to become a *Pencæus*, let them tell me what possibly it can be. The child must surely have a father. Still less than to the prawns would one assign it to any other Crustacean of the Malacostracous division, whether a crab or a woodlouse. Considering that the Phyllopods are wanting in our seas, there remain but the Copepoda, with the Lernæans, and the Cirripedes, with the Rhizocephala as the possible termination of its development.

It is impossible for it to become a Cirripede or a Rhizocephalan; the formation of the heart, liver, and mandibles suffice to demonstrate this. In addition it wants the frontal horns of the Cirripede-larvæ, as well as the spines (*Zacken*) and teeth, with which the third pair of limbs of the *Nauplius* of the Cirripedes is armed. When near passing into a second developmental stage, as the *Nauplius* represented in fig. 2 (*l. c.*) is, we should see in a Cirripede or Rhizocephalan six new pairs of feet under the skin, but not four of them sprouting forth freely on the ventral surface &c. It resembles certain *Nauplius*-forms of the Copepoda much more than those of the Cirripedes. In these also there occur stages of development in which, besides the three original pairs of limbs, rudiments of four new pairs are to be seen. But I do not know from my own experience, nor can I find among the numerous figures which adorn Claus's admirable work on the Copepoda, any form of mandible which could be compared to that of our *Nauplius*. Moreover, in all the marine Copepoda except the Corycæidæ, the third pair of limbs remain a well-bristled mandibular appendage. But, apart from this, the Corycæidæ have no heart such as our *Nauplius* possesses. To this we must add that the *Nauplius* reaches the length of half a

millimetre; it should therefore be considered rather a matured Copepod than the earliest form of such a one. If it belongs to a Copepod it must spring from an unknown gigantic species of a still unknown family; and it is rather strange that this gigantic species has not once fallen into my net during the course of many years.

Itajahy, St. Catherina, Brazil.

June, 1877.

LVI.—*Notes on a Collection of Japanese Sea-Fishes.*

By Dr. A. GÜNTHER, F.R.S.

A COLLECTION of fishes, formed by H. Batson Joyner, Esq., at Tokei, Japan, and presented by him to the British Museum, contained an unusually great proportion of interesting species, several of which are identical with those collected during the expedition of H.M.S. 'Challenger' and noticed in Ann. & Mag. Nat. Hist. 1877, xx. p. 433, whilst a few others appear to be undescribed and will be noticed hereafter.

This collection offers additional confirmation of a fact to which I have repeatedly drawn attention in the 'Catalogue of Fishes' and on subsequent occasions, viz. that there exists the greatest similarity between the marine fauna of temperate Japan and that of the Mediterranean and adjacent parts of the Atlantic, Mr. Joyner's collection containing not less than eight species identical in both seas, viz. *Rhina squatina*, *Pteroplatea hirundo*, *Beryx splendens*, *Beryx decadactylus*, *Hoplostethus mediterraneum*, *Trachurus trachurus*, *Brama Raii*, *Exocoetus lineatus*.

Sebastes Joyneri, sp. n.

D. $\frac{13}{15}$. A. $\frac{3}{7}$. L. lat. ca. 60.

The height of the body is equal to the length of the head, and one third of the total length (without caudal); scales very thin, scarcely serrate, a little smaller above the lateral line than below it; on the upperside of the head they advance to the nostrils and cover the præorbital and maxillary. Snout short, three fourths of the diameter of the eye, which is three tenths of the length of the head, and exceeds by one third the width of the interorbital space, which is flat. Upper surface of head smooth, scarcely armed, the two occipital ridges very low and terminating in short spines; præorbital with two flat spines; præoperculum with five spines,